Available online at www.sciencedirect.com
ScienceDirect
Journal of Forensic and Legal Medicine 15 (2008) 269–273
JOURNAL OF FORENSIC AND LEGAL MEDICINE
www.elsevier.com/jflm

Case Report

Pericial analysis of a dental element found inside food used for human consumption

Rogério Nogueira Oliveira MSc, PhD (Professor) [a,*],
Ricardo Henrique Alves Silva MSc, PhD (Professor) [b],
Silvia de Campos Boldrini MSc, PhD (Professor) [c]

[a] *Social Dentistry Department, Dental School – USP, Avenida Prof. Lineu Prestes, 2227, Cidade Universitária, 05508-000 São Paulo, SP, Brazil*
[b] *Dental School Ribeirão Preto – USP, Avenida do Café s/n, 14040-904 Ribeirão Preto, SP, Brazil*
[c] *Anatomy Department, Biomedical Sciences Institute – USP, Avenida Prof. Lineu Prestes, 2415, Cidade Universitária, 05508-900 São Paulo, SP, Brazil*

Received 15 March 2007; received in revised form 7 August 2007; accepted 8 October 2007
Available online 7 February 2008

Abstract

The field of forensic dentistry embodies the human identification in a lot of conditions. A case is described when a tooth-like object was found in a pork sausage. A lawsuit was filed against the food company and the possible dental element was analysed. The tests used to analyze the case were: scanning electronic microscopic exam, radiographic exam and compared anatomy. The results confirmed that the object found in the sausage pack was a dental element from an adult pig; which had the potential for problems like asphyxia or contamination. The case illustrates one facet of forensic dentistry in Brazil.

Keywords: Forensic dentistry; Health; Liability

1. Introduction

A tooth-like object was found in a pork sausage being eaten in a meal. The family filed a lawsuit against the food company, and the dental element was taken to specialized inspection by this forensic dentistry staff.

Historically, forensic dentistry discipline was established in Brazilian college curriculum, only after Decree no. 19852, edited in 1931.[8] Since then, this specialization has had a continuous development, showing notable scientific and professional advances and forensic anthropology has been one of the areas that best shows this evolution, because it experiences macroscopical observation phases, which are considered simple procedures under the technological aspect, as well as sophisticated laboratory tests, including genetic exams.

Human identification is one of the greatest areas of study and research of forensic sciences, researching the human body with this intention.[12] This complex context requires professionals' efforts with varied experiences, so that the solutions of those cases should be carried out by a team that is capable of using renowned methodologies ranging from those supplied by Physical Anthropology to the new resources of Molecular Biology.[3,10,14]

Forensic dentistry has been established as an important and essential science to solve legal-medical problems and particularly, post-mortem identification, and a great deal of the necessary knowledge to that practice has its origins in basic researches, clinical experiences and advances in Dentistry as a whole.[17]

Several acceptable methods are available to human identification, although still present limitations. Historically, fingerprints have been used in identification; however, in certain situations such as carbonization or decomposition and skeletonization process, they are

* Corresponding author.
E-mail address: rogerion@usp.br (R.N. Oliveira).

1752-928X/$ - see front matter © 2007 Elsevier Ltd and FFLM. All rights reserved.
doi:10.1016/j.jflm.2007.10.007

easily destroyed. Thus, identification through genetic exams is itself an important and reliable tool, but, as well as the dactyloscopy, it needs previous register or presence of some descendant. The anthropological analysis, which in turn, can provide useful information such as height, race, gender, however, does not individually produce identification.[9] Besides human identification, forensic dentistry can be useful to investigative analysis of professional errors, forensic traumatology and tanathology among others.

In this manner, the present case refers to a judicial process in which a dental element was found inside of a commercialized food product (a pack of sausage). An investigative analysis was made necessary in order to check the origin of the element and the risks to human health, considering that its ingestion could lead to asphyxia and even death.

According to reports of Berzlanovich et al.,[2] upper airway obstruction by food or other foreign bodies has been a well known cause of death. And, in a performed study that included 191 cases of fatal asphyxia by foreign body, it could be observed asphyxia cases by raw sausages (19%), dentures (1%), among other elements (hair ornaments, corks).

2. Description of the material presented to the exam

The material was composed by a plastic container having 15 segments of sausage tubes plus 13 sausage slices (Fig. 1). Something similar to a dental crown was observed in one of the tubes (Fig. 2). And that object, after being removed, was confirmed to be a dental element (Fig. 3). The whole material was immersed in preservative liquid (about 600 ml), containing commercial alcohol (about 95%) with formaline solution. The mixture presented acid pH 5.4.

3. Examinations

Besides visual inspection, pH measurement of the material to be inspected as well as the notification of an acceptable mineral state of the given element, the procedures below were also performed.

Fig. 2. Visualization of dental element pre-removal.

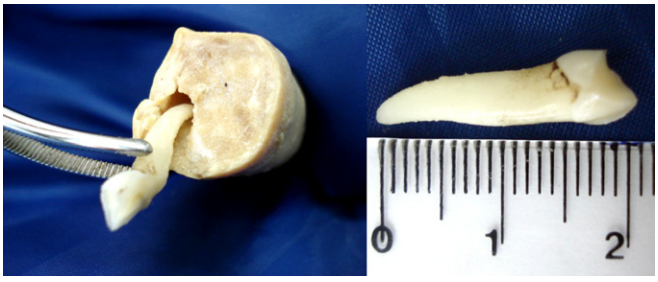

Fig. 3. Visualization of dental element post-removal.

3.1. Radiographic exam

Before any other procedure, the existence of other foreign bodies (teeth) was radiographically verified inside the other sausage tubes which were part of the pack taken to inspection. A lighter radiopaque image was verified in the segment that had already been mentioned in the visual inspection. The image had no variations in the other segments and it could be concluded that there was only the given foreign element (tooth) inside the sausage tubes.

3.2. Compared anatomy examination

A comparative exam was realized between the dental element and the corresponding ones in different animal species, that are part of the collection of the Museum of Vet-

Fig. 1. Presentation of the material for examination.

erinary Anatomy, in the Veterinary Medicine and Zootechny College of the Sao Paulo University (USP), which holds 2000 pieces, ranging from skeletons, taxidermized animals, organs and anatomical structure of several vertebrates, such as pieces of fish, amphibians, reptiles, poultry and mammals.

After the exam, confirmed by professionals of the area of Veterinary Dentistry from USP, it was possible to conclude that the dental fragment was really similar to the swine tooth (Fig. 4), besides presenting atypical anatomical conformation in human dentition.

The comparative observation between the inspected dental element and the corresponding one in the swine also showed that the tooth was fragmented, being originally a biradicular element, as shown in Figs. 5A and B.

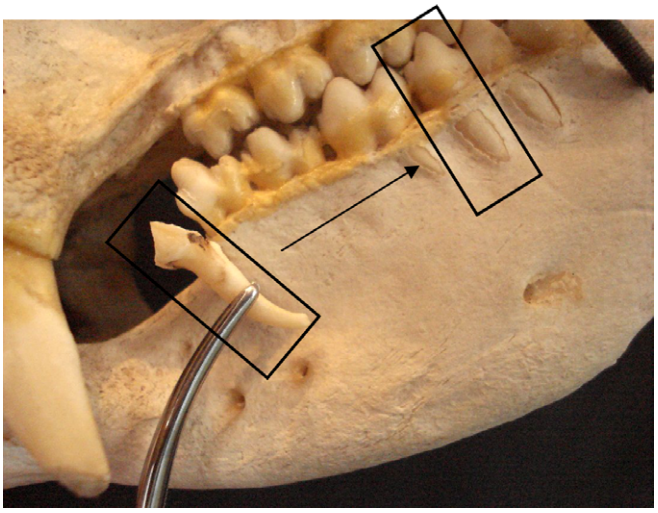

Fig. 4. Comparative exam between the dental element found and swine anatomic piece.

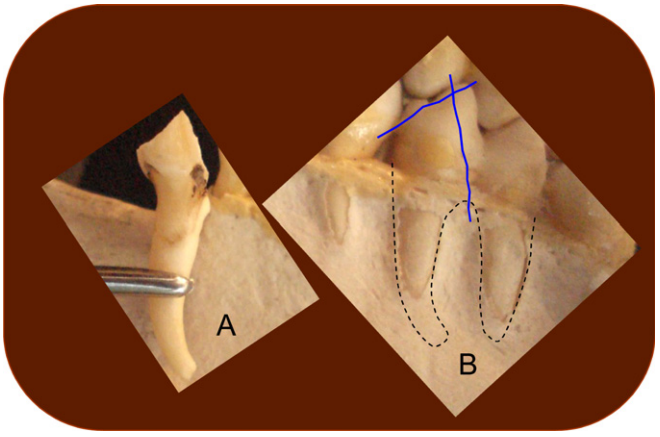

Fig. 5. Comparative analysis between the investigated dental elements (A) and the probable correspondent in swine (B). It is about a swine tooth, correspondent to the indicated element, thus, with two roots. Due to the fact that the element is fragmented, as the lines indicate, it seems to have only one root. Observe the morphologic characteristics of the swine dental roots (B) in position in the respective mandibular bone, through the dotted line, as well as the similarity of the tooth dental root to be investigated (B).

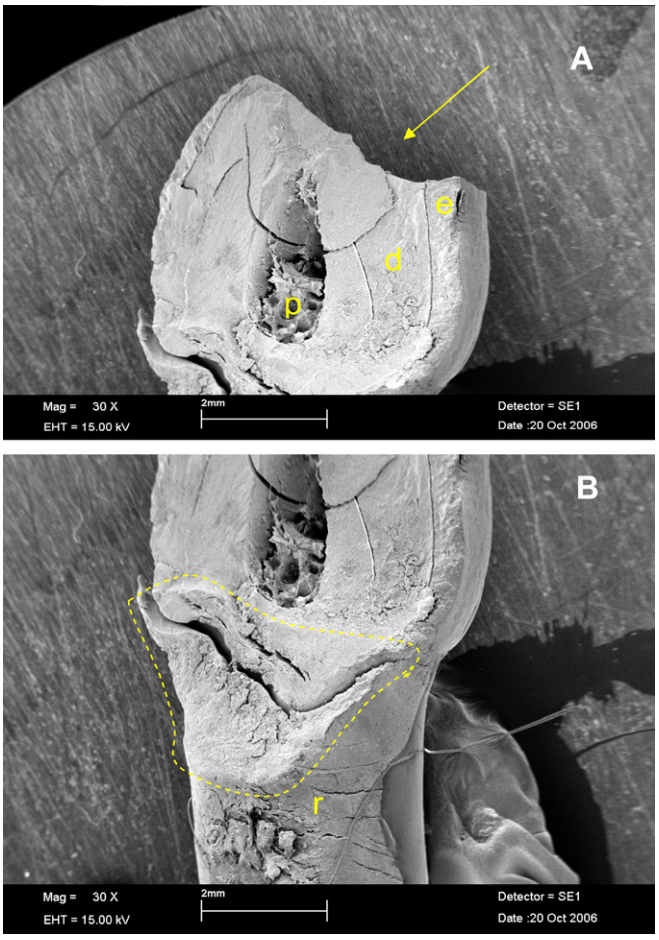

Fig. 6. Scanning electronic microscopy referring to the investigated element (increase: 30×). It is seen from the fracture surface. In A, the superior margin of the fracture and the presence of the characteristic elements of the crown such as enamel (e), dentine (d) and pulp chamber with dental pulp remains (p) are evidenced. In B, we can observe the fracture margin in the bifurcation region between the circumscribed roots in dotted lines and the cervical part of the remaining root (r). Observe the presence of innumerous clefts in the investigated element, both in crown and roots.

3.3. Scanning electronic microscopy exam

Two specimens were prepared to be analyzed: the tooth that was found inside the sausage, the reason why the inspection was realized, and the tooth belonging to the swine, being the latter fractured in an oriented manner with the help of mechanical apprehension claws and fixed in 10% formaline solution. After the washing and dehydration of both specimens in a crescent series of alcohol (from 70 °C to absolute), followed by CO_2 drying process in a critical point apparatus,[d] they were arranged on metallic bases and covered with gold,[e] so that they could be evaluated in scanning electron microscopy.

[d] Balzers CPD 030 (Anatomy Department, Biological Sciences Institute, USP).

[e] Balzers CPD 040 (Anatomy Department, Biological Sciences Institute, USP).

The typical elements of a tooth were displayed, such as dental crown, enamel, dentine and pulp chamber, as well as pulp cavity remnants. The superior margin of the fracture was also displayed, as well as the corresponding region to the bifurcation between the roots (Fig. 6).

Moreover, in the comparison between the inspected element and a swine primary tooth that was previously fractured, it was noticed that dental enamel presented similar characteristics, except for the presence of bacteria, probably due to the period of time and conditions of storage. Dentine observation presented an altered standard, caused by loss of structure (demineralization), due to long time permanence in an acid solution. It had been there for three years, according to the family's report. The official leading of the suit was in May 2004 and the analyses were realized in August and September 2006. The enamel, a tissue with higher mineral content, did not present alterations on its structures, which allowed the comparison (Fig. 7).

4. Discussion

The application of scanning electron microscopy is widely known, and it is an extremely important tool in forensic dentistry. It is mainly used in the analysis of incinerated teeth[7] and incinerated denture,[11] as well as differentiation among teeth, bones and other materials.[16]

The food in discussion (sausage) has always been under frequent quality monitoring by the National Sanitary Surveillance Agency in Brazil, and it was observed that, in the last evaluation (2004–2005), 179 samples of swine sausages were analyzed all over the country and 27% presented unsatisfactory sanitary conditions. The Southeast region presented the highest percentage with 60% out of sanitary standards.[5] The result coincides precisely with the region that had the case in discussion.

Facing that, it is observed that Brazilian Legislation, according to law no. 8.080, denominated Health Organic

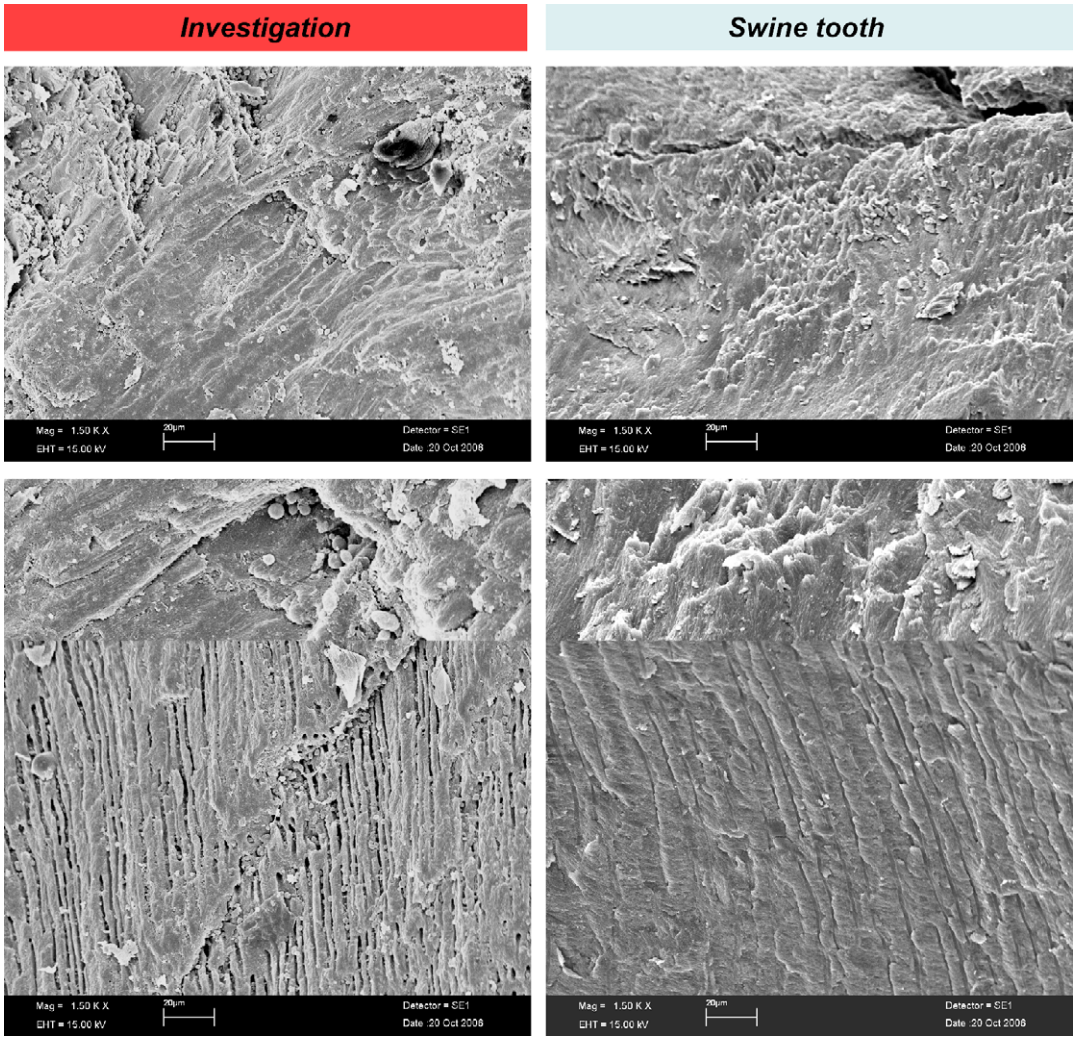

Fig. 7. Scanning electronic microscopy referring to the investigated element (left column) and to a swine primary tooth (right column) previously fractured (increases: a, c, d, f – 1500×; b, e – 4000×). Images a, b, d and e correspond to dental enamel and the ages c and f to the dentine. Observe the same characteristics in a and d, as well as for b and e, because of the presence of bacteria in the investigated element (arrow). In c and f, the dentine standard is not similar, because the long period of exposure in an acid solution caused some structure loss of the dentine (demineralization). The enamel, which is a tissue with higher mineral content, did not present alterations on its structure, and that enabled the comparison.

Law, establishes: "Sanitary Surveillance is understood as a set of actions that are able to eliminate, decrease or prevent risks to health and interfere in sanitary problems caused by the environment, production and circulation of goods and delivery systems concerning health, which embodies: the control of consumer goods which directly or indirectly are related to health, embodying all the stages and processes, from production to consume".[6]

After forensic analysis, it was undoubtedly observed that the foreign body was a tooth, because it is anatomically displayed as a tooth (crown and root), as its mineralized components were macroscopically and microscopically visualized.

Thus, the discussion moves to some points. A hypothetical deglutition and/or aspiration of a foreign body (tooth), independently of toxic or disease components associated to them would already mean a potential risk to health and/or physical integrity of a person, since the foreign body could pass through the whole digestive tract without further consequences, but it could have caused suffocation or eventual gastric problems. It is not possible to predict certain prognostic.

The incidence of asphyxia caused by food varies among populations and different ages; there are about 0.1 or 2 cases out of 100.000.[1,13] Moreover, a deficient dentition is another risk factor, and much care is necessary in the examinations of asphyxia cases because, as Wick et al.[18] states, only 37% has a proper natural dentition.

The aspiration of food or gastric content can be observed in a great number of accidental deaths, as Bockholdt et al.[4] points out. In this case, there was inherent risk, although it was not rendered because of the previous discovery of the dental element.

Concerning the possibility of the found element (tooth) has not been inlayed in the same process of the sausage, we can notice, through the analysis of the investigated material (Figs. 1–3), its uniformity in aspect, that is, the sausage tubes that contained the tooth, as the other ones, presented similar size, color and texture, which indicates that they were beneficed at the same period. Another perceptive aspect to visual analysis is that the borders of the cut section of the tube that contained the tooth are not inverted (Fig. 3), and that also contributes to the supposition that the tooth was processed with the sausage material, and that it was not included there on purpose.

Moreover, according to Teletchea et al.[15], recent alimentary shocks that were displayed, lapses in the food production, as well as allergies, among others, have strongly showed the necessity of inspection and observation of the products composition.

We must stand out that age is one of the fundamental items in the identification process and it means that the older it is, the bigger the methodological difficulty. In this case, since the tooth crown is completely formed, it shows that the specimen comes from an adult animal, because from this phase on, the dental element would not present so much evident variations, even if they have already reached senility. That is different from what happens in precocious ages, in which innumerous morphologic characteristics are peculiar between short periods. Hence, particularizing this age would not be possible in the present context.

5. Conclusions

This case, which concluded the investigated material has the anatomic, radiographic and microscopic characteristics of a dental element compatible to the swine specimen, is an example of the role of forensic dentistry in Brazil.

References

1. Berzlanovich AM, Fazeny-Dörner B, Waldhoer T, Fasching P, Keil W. Foreign body asphyxia: a preventable cause of death in the elderly. *Am J Prev Med* 2005;**28**:65–9.
2. Berzlanovich AM, Muhm M, Sim E, Bauer G. Foreign body asphyxiation – an autopsy study. *Am J Med* 1999;**107**:351–5.
3. Bilge Y, Kedici PS, Alakoc YD, et al. The identification of a dismembered human body: a multidisciplinary approach. *Forensic Sci Int* 2003;**137**:141–6.
4. Bockholdt B, Ehrlich E, Maxeiner H. Forensic importance of aspiration. *Int Legal Med* 2003;**5**:S311–4.
5. Brazil. Anvisa. Available programs' results of food tests. Available on URL: http://www.anvisa.gov.br.
6. Brazil. Health Ministery. Law 8080: conditions of promotion, protection and recovery of health, the organization and function of correspondent services. Brasilia: Federal Official Diary; 1990. p. 794.
7. Bush MA, Bush PJ, Miller RG. Detection and classification of composite resins in incinerated teeth for forensic purposes. *J Forensic Sci* 2006;**51**:636–42.
8. Côrrea R. Comment and notes about dentistry regulaments. In: Côrrea R, editor. *Dentistry regulaments*. Curitiba: Instituto Paranaense de Estudos Superiores; 1976. p. 7–39.
9. Glass RT. Body identification by forensic dental means. *Gen Dent* 2002;**50**:34–8.
10. Iscan MY, Olivera HE. Forensic anthropology in Latin America. *Forensic Sci Int* 2000;**109**:15–30.
11. Merlati G, Danesino P, Savio C, Fassina G, Osculati A, Menghini P. Observations on dental prostheses and restorations subjected to high temperatures: experimental studies to aid identification processes. *J Forensic Odontostomatol* 2002;**20**:17–24.
12. Oliveira RN, Daruge E, Galvão LCC, Tumang AJ. Forensic dentistry role on post-mortem identification. *Rev Bras Odontol* 1998;**55**:117–22.
13. Ruschena D, Mullen PE, Palmer S, et al. Choking deaths: the role of antipsychotic medication. *Br J Psychiat* 2003;**183**:446–50.
14. Silva RHA, Musse JO, Melani RFH, Oliveira RN. Human bite mark identification and DNA technology in forensic dentistry. *Braz J Oral Sci* 2006;**5**:1193–7.
15. Teletchea F, Maudet C, Hänni C. Food and forensic molecular identification: update and challenges. *Trends Biotech* 2005;**23**:1–8.
16. Ubelaker DH, Ward DC, Braz VS, Stewart J. The use of SEM/EDS analysis to distinguish dental and osseus tissue from other materials. *J Forensic Sci* 2002;**47**:940–3.
17. Whittaker DK. Research in forensic odontology. *Ann R Coll Surg Engl* 1982;**64**:175–9.
18. Wick R, Gilbert JD, Byard RW. Cafe coronary syndrome-fatal choking on food: an autopsy approach. *J Clin Forensic Med* 2006;**13**:135–8.